CLAIMS

What is claimed is:

CLAIMS:

1.   A method of implementing storage virtualization in a storage area network, the method comprising:

creating a virtual enclosure, the virtual enclosure having one or more virtual enclosure ports and being adapted for representing one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage units of the storage area network;

associating each of the virtual enclosure ports of the virtual enclosure with a port of a network device within the storage area network; and

assigning an address or identifier to each of the virtual enclosure ports.

2.   The method as recited in claim 1, wherein associating each of the virtual enclosure ports of the virtual enclosure with a port of a network device within the storage area network comprises:

instructing a port of a network device within the storage area network to handle messages addressed to the address or identifier assigned to the associated virtual enclosure port.

3.   The method as recited in claim 1, wherein associating each of the virtual

enclosure ports of the virtual enclosure with a port of a network device within the storage area network comprises:

instructing a port of a network device within a virtual SAN to handle messages addressed to the address or identifier assigned to the associated virtual enclosure port.

4.   The method as recited in claim 1, further comprising:

associating a Node World Wide Name with the virtual enclosure.

5.   The method as recited in claim 4, further comprising:

assigning a Port World Wide Name to each of the virtual enclosure ports such that the Port World Wide Name is associated with an associated port of a network device within the storage area network.

6.   The method as recited in claim 1, wherein the port of the network device within the storage area network is a port of a fibre channel device.

7.   The method as recited in claim 1, wherein assigning an address or identifier to each of the virtual enclosure ports comprises:

assigning a FCID to each of the virtual enclosure ports.

8.   The method as recited in claim 1, further comprising:

selecting a number of virtual enclosure ports of the virtual enclosure.

9.   The method as recited in claim 8, wherein the number of virtual enclosure ports of the virtual enclosure is greater than a number of ports of each network device within the storage area network.

10.   The method as recited in claim 1, wherein associating each of the virtual enclosure ports of the virtual enclosure with a port of a network device within the storage area network comprises:

associating the virtual enclosure ports with ports of one or more network devices within the storage area network.

11.   The method as recited in claim 1, wherein associating each of the virtual enclosure ports of the virtual enclosure with a port of a network device within the storage area network comprises:

binding a port of a network device within the storage area network to one or more of the virtual enclosure ports.

12.   The method as recited in claim 11, further comprising:

instructing one or more additional ports of one or more network devices within the storage area network to trap messages directed to one of the virtual enclosure ports.

13.   The method as recited in claim 1, wherein one or more of the virtual storage

units each comprises a VLUN or other virtual representation of storage on the storage

area network.

14.   The method as recited in claim 1, further comprising:

assigning one or more virtual storage units to the virtual enclosure.

15.   The method as recited in claim 14, wherein the one or more virtual storage

units each comprise a VLUN or other virtual representation of storage on the storage

area network.

16.   A computer-readable medium storing thereon computer-readable instructions

for implementing storage virtualization in a storage area network, comprising:

instructions for creating a virtual enclosure, the virtual enclosure having one or

more virtual enclosure ports and adapted for representing one or more virtual storage

units, each of the virtual storage units representing one or more physical storage

locations on one or more physical storage units of the storage area network;

instructions for associating each of the virtual enclosure ports of the virtual

enclosure with a port of a network device within the storage area network; and

instructions for assigning an address or identifier to each of the virtual

enclosure ports.

17.   An apparatus for implementing storage virtualization in a storage area

network, comprising:

means for creating a virtual enclosure, the virtual enclosure having one or more virtual enclosure ports and adapted for representing one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage units of the storage area network;

means for associating each of the virtual enclosure ports of the virtual enclosure with a port of a network device within the storage area network; and

means for assigning an address or identifier to each of the virtual enclosure ports.

18.   A network device adapted for implementing storage virtualization in a storage area network, comprising:

a processor; and

a memory, at least one of the processor and the memory being adapted for:

creating a virtual enclosure, the virtual enclosure having one or more virtual enclosure ports and adapted for representing one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage units of the storage area network;

associating each of the virtual enclosure ports of the virtual enclosure with a port of a network device within the storage area network; and

assigning an address or identifier to each of the virtual enclosure ports.

19.   A method of performing LUN mapping in a storage area network, the method comprising:

accessing a LUN mapping table having one or more entries, each of the entries identifying an initiator in the storage area network, one or more of a set of one or more virtual enclosure ports of a virtual enclosure, and associating a specified logical unit with one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage units of the storage area network, wherein the virtual enclosure is adapted for representing the set of one or more virtual storage units and each of the virtual enclosure ports is associated with a port of a network device within the storage area network; and

when a request for the specified logical unit is received from the initiator via one of the associated virtual enclosure ports, identifying one of the entries in the LUN mapping table and employing the one or more virtual storage units specified in the entry to service the request.

20.   A computer-readable medium storing thereon instructions for performing LUN mapping in a storage area network, comprising:

instructions for accessing a LUN mapping table having one or more entries, each of the entries identifying an initiator in the storage area network, one or more of a set of one or more virtual enclosure ports of a virtual enclosure, and associating a specified logical unit with one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage units of the storage area network, wherein the virtual enclosure is adapted for representing the set of one or more virtual storage units and each of the virtual enclosure ports is associated with a port of a network device within the storage area network; and

instructions for identifying one of the entries in the LUN mapping table and employing the one or more virtual storage units specified in the entry to service the request when a request for the specified logical unit is received from the initiator via one of the associated virtual enclosure ports.

21.   A method of implementing storage virtualization in a storage area network, the method comprising:

sending a virtualization message to a port of a network device within the storage area network, the virtualization message instructing the port to handle messages addressed to a virtual enclosure port of a virtual enclosure, the virtual enclosure having one or more virtual enclosure ports and being adapted for representing one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage units of the storage area network; and

receiving a virtualization response from the port of the network device in response to the virtualization message.

22.   The method as recited in claim 21, wherein the virtual enclosure port is identified by a NWWN and a PWWN.

23.   The method as recited in claim 21, wherein the virtualization response indicates that the port is configured to handle messages addressed to the virtual enclosure port of the virtual enclosure.

24.   The method as recited in claim 21, wherein the virtualization message indicates that the port is to obtain an address or identifier assigned to the virtual enclosure port.

25.   The method as recited in claim 24, wherein the virtualization message is a bind message or a trap message.

26.   The method as recited in claim 24, wherein the virtualization response comprises the address or identifier assigned to the virtual enclosure port.

27.   The method as recited in claim 21, wherein the virtualization message indicates that the port is to obtain an address or identifier assigned to the virtual enclosure port from a DNS server.

28.   The method as recited in claim 24, further comprising:
        receiving the address or identifier assigned to the virtual enclosure port.

29.   The method as recited in claim 24, wherein the address or identifier is an FCID.

30.   The method as recited in claim 21, wherein the virtualization message indicates that the port is to handle messages addressed to an address or identifier

assigned to the virtual enclosure port.

31.   The method as recited in claim 30, wherein the address or identifier is an FCID.

32.   A computer-readable medium storing thereon computer-readable instructions for implementing storage virtualization in a storage area network, comprising:

instructions for sending a virtualization message to a port of a network device within the storage area network, the virtualization message instructing the port to handle messages addressed to a virtual enclosure port of a virtual enclosure, the virtual enclosure having one or more virtual enclosure ports and being adapted for representing one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage units of the storage area network; and

instructions for receiving a virtualization response from the port of the network device in response to the virtualization message.

33.   An apparatus adapted for implementing storage virtualization in a storage area network, comprising:

means for sending a virtualization message to a port of a network device within the storage area network, the virtualization message instructing the port to handle messages addressed to a virtual enclosure port of a virtual enclosure, the virtual enclosure having one or more virtual enclosure ports and being adapted for representing one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage

units of the storage area network; and

        means for receiving a virtualization response from the port of the network

device in response to the virtualization message.

34.   An apparatus adapted for implementing storage virtualization in a storage area

network, comprising:

        a processor; and

        a memory, at least one of the processor and the memory being adapted for:

        sending a virtualization message to a port of a network device within the

storage area network, the virtualization message instructing the port to handle

messages addressed to a virtual enclosure port of a virtual enclosure, the virtual

enclosure having one or more virtual enclosure ports and being adapted for

representing one or more virtual storage units, each of the virtual storage units

representing one or more physical storage locations on one or more physical storage

units of the storage area network; and

        receiving a virtualization response from the port of the network device in

response to the virtualization message.

35.   A method of implementing storage virtualization in a storage area network, the

method comprising:

        receiving a virtualization message at a port of a network device within the

storage area network, the virtualization message instructing the port to handle

messages addressed to a virtual enclosure port of a virtual enclosure, the virtual

enclosure having one or more virtual enclosure ports and being adapted for

representing one or more virtual storage units, each of the virtual storage units

representing one or more physical storage locations on one or more physical storage

units of the storage area network; and

sending a virtualization response from the port of the network device in

response to the virtualization message.

36.   The method as recited in claim 35, wherein the virtualization message

indicates that the port is to obtain an address or identifier assigned to the virtual

enclosure port, the method further comprising:

obtaining the address or identifier assigned to the virtual enclosure port.

37.   The method as recited in claim 36, further comprising:

storing the address or identifier.

38.   The method as recited in claim 35, wherein the virtualization message

indicates that the port is to obtain an address or identifier assigned to the virtual

enclosure port from a DNS server, the method further comprising:

obtaining the address or identifier assigned to the virtual enclosure port.

39.   The method as recited in claim 36, further comprising:

sending the address or identifier assigned to the virtual enclosure port.

40.   The method as recited in claim 36, wherein the address or identifier is an

FCID.

41. The method as recited in claim 35, wherein the virtualization message indicates that the port is to handle messages addressed to an address or identifier assigned to the virtual enclosure port.

42. The method as recited in claim 41, wherein the address or identifier is an FCID.

43. The method as recited in claim 41, further comprising:

handling messages addressed to the address or identifier assigned to the virtual enclosure port.

44. The method as recited in claim 35, further comprising:

handling messages addressed to the virtual enclosure port of the virtual enclosure.

45. The method as recited in claim 36, further comprising:

handling messages addressed to the address or identifier assigned to the virtual enclosure port.

46. The method as recited in claim 35, further comprising:

receiving a report message requesting an identification of one or more of the

virtual storage units supported by an address or identifier assigned to one of the virtual enclosure ports;

sending a reply message identifying one or more of the virtual storage units.

47. The method as recited in claim 46, wherein the address or identifier is an FCID.

48. The method as recited in claim 46, wherein one or more of the virtual storage units comprises a VLUN or other virtual representation of storage on the storage area network.

49. The method as recited in claim 46, wherein the one or more of the virtual storage units identified in the reply message are those virtual storage units that are visible to an initiator sending the report message.

50. A computer-readable medium storing thereon computer readable instructions for implementing storage virtualization in a storage area network, comprising:

instructions for receiving a virtualization message at a port of a network device within the storage area network, the virtualization message instructing the port to handle messages addressed to a virtual enclosure port of a virtual enclosure, the virtual enclosure having one or more virtual enclosure ports and being adapted for representing one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage units of the storage area network; and

instructions sending a virtualization response from the port of the network

device in response to the virtualization message.

51.   A network device adapted for implementing storage virtualization in a storage area network, comprising:

means for receiving a virtualization message at a port of a network device within the storage area network, the virtualization message instructing the port to handle messages addressed to a virtual enclosure port of a virtual enclosure, the virtual enclosure having one or more virtual enclosure ports and being adapted for representing one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage units of the storage area network; and

means for sending a virtualization response from the port of the network device in response to the virtualization message.

52.   A network device adapted for implementing storage virtualization in a storage area network, comprising:

a processor; and

a memory, at least one of the processor and the memory being adapted for:

receiving a virtualization message at a port of a network device within the storage area network, the virtualization message instructing the port to handle messages addressed to a virtual enclosure port of a virtual enclosure, the virtual enclosure having one or more virtual enclosure ports and being adapted for representing one or more virtual storage units, each of the virtual storage units representing one or more physical storage locations on one or more physical storage

units of the storage area network; and

sending a virtualization response from the port of the network device in

response to the virtualization message.